PATENT SPECIFICATION

Application Date: Feb. 14, 1923. *No. 4379/23.* **215,832**

Complete Left: Nov. 9, 1923.

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PROVISIONAL SPECIFICATION.

Improvements in and relating to Means for Deaerating Water and particularly Feed Water for Steam Boilers.

We, JAMES ERNEST JOHNSON, of Soho Iron Works, Bolton, in the County of Lancaster, a subject of the King of Great Britain and Ireland, and HICK, HARGREAVES AND COMPANY, LIMITED, of Soho Iron Works, Bolton, in the County of Lancaster, a company registered under the laws of Great Britain, do hereby declare the nature of this invention to be as follows:—

The invention relates to means or plant for deaerating water or removing air or gases therefrom, and is particularly applicable to the treatment of feed water intended for steam boilers.

The more extended use of water tube boilers has brought out the fact that they are more susceptible to deterioration by corrosion than boilers of the Lancashire type. On the other hand, they have many advantages over the latter type of boiler, the principal of which is their capacity to withstand a high working pressure, in addition to which it is possible to build them in single units of high evaporative capacity. The result is that the water tube boiler is used to the exclusion of any other type, and providing the feed water can be deaerated so as to eliminate the oxygen content, the boilers are found to meet all requirements.

In view of the high steam pressures now carried in power station work, the fuel economiser placed in the main flue to the chimney stack, hitherto made up of cast iron pipes, has had to make way for a similar type of apparatus constructed in wrought and cast steel. It is therefore equally necessary, as in the case of the water tube boiler, to deaerate the water if corrosion troubles are to be eliminated. Corrosion when once set up, quickly eats away the tubes and also the tube headers, rendering necessary very expensive replacements to these parts.

An object of the present invention is to overcome the above defects and to provide an efficient and improved plant or means whereby water (feed water) may be deaerated and rendered suitable for use in installations where water tube boilers or steel economisers are employed.

A further object of the invention is to provide deaeration means of a compact or self-contained nature which may be applied or introduced as a unit to existing steam condensing and feed water systems without disturbing or materially modifying the apparatus or machinery already in position or operation.

The invention comprises a container in which the water to be deaerated is broken up or atomised a steam jet air extractor adapted to exhaust or remove air or gases freed within the container, and a heater adapted to raise the temperature of the water before entry into the container and to which the air ejector may deliver.

Further features of the invention will be hereinafter described.

In carrying the invention into effect according to one convenient mode, by way of example, a container or vessel of suitable shape and capacity is provided with an inlet through which the water to be deaerated is admitted. This inlet or conduit delivers through a series of jets or nozzles or other suitable means whereby the feed water is sprayed to break it up into fine particles or to atomise it. The sprayed or atomised feed water is preferably introduced into the lower part of the vessel and directed upwardly.

At or towards the upper end of the vessel an outlet is provided to which is connected a steam jet air ejector adapted to exhaust or draw air or gas which has

been liberated in the breaking up or atomising of the feed water, from the container.

It will be appreciated that during the operation of the device the feed water after being atomised and after having given up its air, will fall back and collect or tend to collect in the lower portion of the container.

At the lower end or in the bottom of the container or vessel a conduit may lead away the deaerated feed water to the boiler feed pumps or to an intermediate lift pump.

A float device may be provided within the container and connected to a valve adapted to control the inlet of feed water to the container according to the quantity of water standing in the container.

A feed water heater is provided and is located preferably immediately adjacent the container or vessel above described. This feed water heater may comprise a coil through which the feed water is adapted to pass, an inlet thereto which may be connected to the existing hot well of any plant and an outlet directly connected to the inlet to the deaerating vessel or container.

The steam air extractor delivers into the feed water heater and the exhaust steam therefrom may be utilised to heat the feed water. If desired, the feed water heater may receive additional heating steam from auxiliary engines or steam may be bled from main or auxiliary plant for this purpose.

The feed water heater is provided with an air vent or outlet for the escape of air delivered by the ejector. This air vent may be mounted upon a drain pipe adapted to carry off the condensate which may collect within the feed water heater.

It will be appreciated from the above description that the deaerating vessel, ejector and feed water heater, comprises a compact unit which may be applied or utilised in any existing system. For example by the provision of a downtake pipe or suitable pipe connection, the feed water heater may be connected with an existing hot well or feed tank and the water outlet from the deaerating vessel may be in the form of a pipe or conduit which may be coupled to the usual pipe line leading to the feed pump.

In operation, should a heavy demand for feed water arise, the float in the deaerator will fall with the result that more water will be admitted through the valve control to the deaerator, the reverse action taking place should the feed water requirements be curtailed.

The use of the ejector for extracting the air from the deaerator operates to permit the feed water to enter the system from the hot well or other reservoir under the influence of atmospheric pressure, so that the employment of a pump for this purpose is obviated.

Where the feed pumps are of the centrifugal type a lift pump may be necessary in order to provide a suction head therefor.

Dated this 14th day of February, 1923.

MARKS & CLERK.

COMPLETE SPECIFICATION.

Improvements in and relating to Means for De-aerating Water and particularly Feed Water for Steam Boilers.

We, JAMES ERNEST JOHNSON, of Soho Iron Works, Bolton, in the County of Lancaster, a subject of the King of Great Britain and Ireland, and HICK, HARGREAVES AND COMPANY, LIMITED, of Soho Iron Works, Bolton, in the County of Lancaster, a company registered under the laws of Great Britain, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to means or plant for deaerating water or removing air or gases therefrom, of the type comprising a container or vessel in which the water to be deaerated is sprayed and from which the air and gases freed within the container are exhausted and a heater adapted to raise the temperature of the water before entering the container.

The more extended use of water tube boilers has brought out the fact that they are more susceptible to deterioration by corrosion than boilers of the Lancashire type. On the other hand, they have many advantages over the latter type of boiler the principal of which is their capacity to withstand a high working pressure, in addition to which it is possible to build them in single units of high evaporative capacity. The result is that the water tube boiler is used to the exclusion of any other type and, providing the feed water can be de-aerated so as to eliminate the oxygen and carbon dioxide contents, the boilers are found to meet all requirements.

In view of the high steam pressures now

carried in power station work, the fuel economiser placed in the main flue to the chimney stack, hitherto made up of cast iron pipes, has had to make way for a similar type of apparatus constructed in wrought and cast steel. It is, therefore, equally necessary, as in the case of the water tube boiler to de-aerate the water if corrosion troubles are to be eliminated. Corrosion when once set up quickly eats away the tubes and also the tube headers, rendering necessary very expensive replacement to these parts.

An object of the present invention is to overcome the above defects and to provide an efficient and improved plant or means whereby water (feed water) may be de-aerated and rendered suitable for use in installations where water tube boilers or steel economisers are employed.

A further object of the invention is to provide deaeration means of a compact or self-contained nature which may be applied or introduced as a unit to existing steam condensing and feed water systems without disturbing or materially modifying the apparatus or machinery already in position or operation.

The invention consists in a deaerating plant of the type described comprising a container in which the water to be de-aerated is sprayed and from which the air or gases freed within the container are exhausted and a heater adapted to raise the temperature of the water before entry into the container, and is characterised by the feature that the water is introduced into the lower part of the container and directed upwardly in an atomised condition or in a fine spray.

The invention also consists of a deaerating plant of the type described comprising in combination a deaerating vessel wherein the water to be deaerated is directed upwardly in an atomised condition or in a fine spray, the inlet for the water being controlled by a float valve, and the liberated air or gas is withdrawn by connection of the vessel with a source of vacuum, a heater through which the water to be deaerated passes to the vessel and means for delivering condensation water from the heater to a tank at atmospheric pressure and supplying such to the vessel under the influence of the reduced pressure therein.

In the accompanying drawings:—

Figure 1 is a side elevation of a deaerating plant constructed according to the invention;

Figure 2 is a side elevation of a modified design of de-aerating plant according to the invention.

In carrying the invention into effect according to one convenient mode by way of example, a container or vessel *a* (Figures 1 and 2) of suitable shape and capacity is provided with an inlet a^1 through which the water to be de-aerated is admitted. This inlet or conduit delivers through a series of jets or nozzles a^2 or other suitable means whereby the feed water is sprayed to break it up into fine particles or to atomise it. The atomised feed water is introduced into the lower part of the vessel and directed upwardly.

At or towards the upper end of the vessel an outlet a^3 is provided to which is connected a steam jet air ejector *b* adapted to exhaust or draw air or gas, which has been liberated in the breaking up or atomising of the feed water, from the container. The air and gases from the outlet a^3 may pass through an intercepter or trap b^1 (Figure 1) the drain from which may be carried back through a pipe b^2 to the vessel *a*.

It will be appreciated that during the operation of the device the feed water after being atomised and after having given up its air will fall back and collect or tend to collect in the lower portion of the container.

At the lower end (Figure 1) or in the bottom (Figure 2) of the container or vessel *a* a conduit a^4 may lead away the de-aerated feed water to the boiler feed pumps (Figure 1) or to an extraction pump (Figure 2).

In the form illustrated in Figure 1 a valve is shown controlling the outlet a^4 and the outlet delivers directly to a centrifugal pump *c* which may have a pipe c^1 passing from the suction side of the pump back to the vessel *a* for the purpose of by-passing any air or gases which might otherwise tend to collect.

A float device a^5 may be provided within the container *a* and connected to a valve adapted to control the inlet of feed water to the container according to the quantity of water standing in the container.

A feed water heater *d* is provided and is located preferably immediately adjacent the container or vessel above described. This feed water heater may comprise a coil d^1 (Figure 2) through which the feed water is adapted to pass and has an inlet d^2 which may be connected to the existing hot well *e* of any plant and an outlet d^3 (which may be valve controlled) directly connected to the inlet a^1 of the de-aerating vessel or container *a*.

The steam air extractor *b* delivers into the feed water heater and the exhaust steam therefrom may be utilised to heat the feed water. If desired, the feed

water heater may receive additional heating steam through the conduit d^4 from auxiliary engines or steam may be bled from main or auxiliary plant for this purpose.

The feed water heater is provided with an air vent or outlet d^2 for the escape of air delivered by the ejector. This air vent may be mounted upon a drain pipe d^3 (Figure 2) adapted to carry off the condensate which may collect within the feed water heater.

Alternatively, the feed water heater may have an outlet drain d^6 (Figure 1) to a well f. This well may be connected to the vessel a by a pipe f^1 controlled by a ball float valve f^2, so that as the float rises water is permitted to pass into the vessel a by reason of its reduced pressure. Thermometers such as g may be introduced where desired to indicate the temperature at various points.

It will be appreciated from the above description that the de-aerating vessel, ejector and feed water heater comprise a compact unit which may be applied or utilised in any existing system. For example, by the provision of a downtake pipe or suitable pipe connection the feed water heater may be connected with an existing hot well or feed tank and the water outlet from the de-aerating vessel may be in the form of a pipe or conduit which may be coupled to the usual pipe line leading to the feed pump.

In operation, should a heavy demand for feed water arise the float a^3 in the de-aerator will fall with the result that more water will be admitted through the valve control to the de-aerator, the reverse action taking place should the feed water requirements be curtailed.

The use of the ejector for extracting the air from the deaerator operates to permit the feed water to enter the system from the hot well or other reservoir under the influence of atmospheric pressure so that the employment of a pump for this purpose is obviated.

Where the feed pumps are of the centrifugal type a lift pump may be necessary in order to provide a suction head therefor.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A deaerating plant adapted for the purposes described and of the type comprising a container or vessel into which the water to be deaerated is sprayed and from which the air or gases freed within the container are exhausted and a heater adapted to raise the temperature of the water before entering into the container or vessel, characterised by the feature that the water is introduced into the lower part of the container and directed upwardly in an atomised condition or in a fine spray.

2. A deaerating plant as claimed in Claim 1 characterised in this that the heater discharges to a well connected to the deaerating vessel by a pipe line controlled by a ball float valve.

3. A deaerating plant as claimed in Claim 1, characterised is this, that a connection is provided between the deaerating vessel and the suction of a pump adapted to discharge water from the vessel for the purposes described.

4. A deaerating plant as claimed in Claim 1, 2 or 3, characterised in this, that a trap or intercepter having a drain back to the deaerating vessel is located between the steam jet air extractor and the vessel.

5. A deaerating plant of the type described comprising in combination a deaerating vessel wherein the water to be deaerated is directed upwardly in an atomised condition or in a fine spray, the inlet for the water being controlled by a float valve, and the liberated air or gas is withdrawn by connection of the vessel with a source of vacuum, a heater through which the water to be deaerated passes to the vessel and means for delivering condensation water from the heater to a tank at atmospheric pressure and supplying such to the vessel under the influence of the reduced pressure therein.

6. A deaerating plant as claimed in Claim 1, 2, 3, 4 or 5, characterised in this, that the heater is provided with a water inlet and the deaerating vessel is provided with a water outlet adapted to be respectively connected to an existing source of supply and to existing boiler feed water pumps of any installation into which the improved plant may be introduced.

7. The improved deaerating plant substantially as described and as illustrated in the accompanying drawings.

Dated this 9th day of November, 1923.

MARKS & CLERK.

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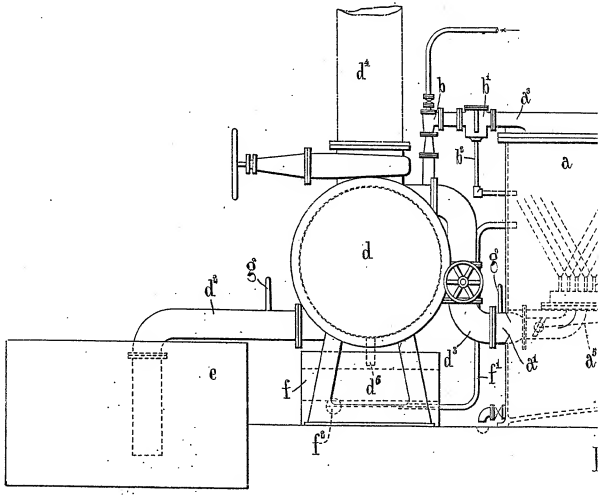
[This Drawing is a reproduction of the Original on a reduced scale.]



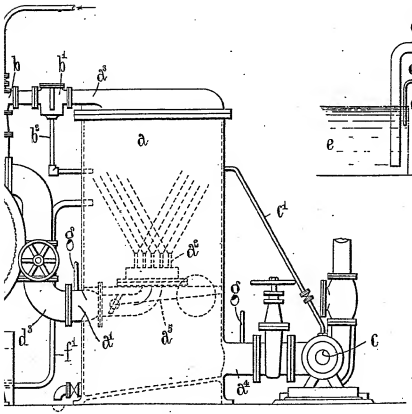


Fig. 1.

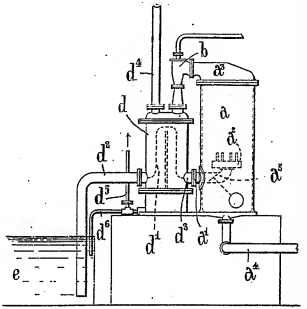


Fig. 2.

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[This Drawing is a reproduction of the Original on a reduced scale.]

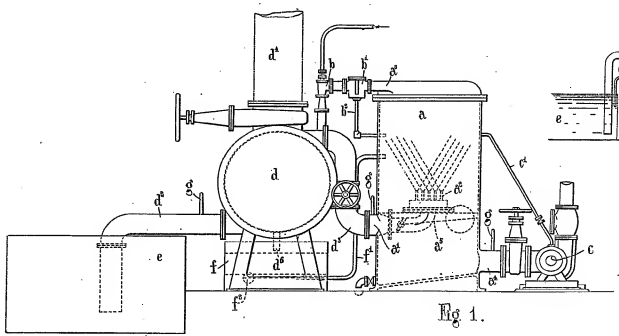

Fig. 1.

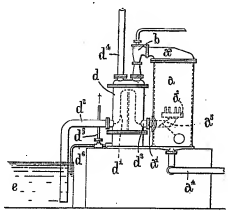

Fig. 2.

Malby & Sons, Photo-Lith.